siderata of the Herbarium for North America north of Mexico," including Ranunculaceæ to Rosaceæ. We trust that botanists will very generally respond to the appeal for specimens.

ENTOMOLOGY.[1]

On the Homologies of the Wing-Veins of Insects.—Using the conclusions of Adolph[2] as a starting-point, Redtenbacher[3] has made a very elaborate investigation into the homologies of the veins of the wings of insects; and, although his conclusions may not be generally accepted, they will be of interest to all systematic entomologists. The work treats of each of the orders of winged insects, and is illustrated by twelve plates, upon which are one hundred and sixty figures of the wings of insects. We have space for only a few extracts from the introductory portions of the memoir.

The geologically-older insects have a richer venation than the later-appearing forms. It is evident from this that the oldest insect-forms were provided, so to speak, with a superfluity of veins, and that in the course of development all that were superfluous have been lost. In this way simpler wing-venation has been brought about.

Various views are held regarding the origin of the wings. While some believe the wings to be sac-like prolongations of the body-wall, Fritz Müller calls them lateral continuations of the dorsal plates. Oken, Graber, Gegenbauer, Landois, Palmèn, see in them metamorphosed tracheal gills. Weissmann is of the opinion that the wing-nuclei form themselves out of the peritoneal sheath of tracheal trunks, and only secondarily cause a prolongation of the body-wall.

That the wings of insects are equivalent to the tracheal gills of the *Ephemerid* larva can hardly admit of a doubt. Whether they have arisen out of tracheal gills is still questionable, for it is not beyond the range of possibility that the opposite is the case,—viz., that wings, through metamorphosis, become tracheal gills. It is not only possible, but even probable, that the wings of insects were originally not active, but merely passive, organs of motion, serving, like the pappus of the Compositæ, for example, for the floating and spreading of the progeny to a distance.

The essential nature of a rudimentary wing is a hollow sac, which is filled with blood-liquid, contains nerves and tracheal filaments, and whose two plates do not grow together until the

[1] This department is edited by Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] Ueber Insectenflügel, von Dr. G. Ernst Adolph, Nova Acta der ksl. Leop.-Carol.-Deutschen Akademie der Naturforscher. Band xli. Pars II., Nr. 3. Halle, 1879.

[3] Vergleichende Studien über das Flugelgeäder der Insecten, von Josef Redtenbacher, Annalen des k. k. Naturhistorischen Hofmuseums. Band i. pp. 153–231. Wien, 1886.

last moult. According to Adolph, these tracheal filaments represent the foundation of the vein-system,—to wit, of the concave veins; since the course of these, in the rudimentary wing, coincides completely with the net-work of concave veins in the developed wing. Only later is every trachea shut in and closed by chitine-mass, and thereby transformed into a rib. At the same time, according to Adolph, the tracheæ force the two wing-plates apart and beget a *thinning* of the wing-skin, which shows itself, among other ways, by the fact that the wings, in case of pressure or draught, regularly tear along the concave veins. Between these primary or concave veins appear later *thickenings* of the wing-skin, in the form of chitine lines, with which, finally, tracheæ and blood-vessels associate themselves, and which form secondary, or convex, veins. The two sorts of veins stand, accordingly, in direct opposition to each other; since the former is caused by *thinning* and the latter by *thickening* of the wing-skin; and since in the former the trachea, in the latter the chitine-band, represents the primary formation.

A circumstance not brought out by Adolph is that the two forms of veins occupy different superficial layers, since the primary run on a deeper level than the secondary; whence the former may be designated as concave or valley veins, the latter as convex or mountain veins. In the case of a regular succession of veins the transverse section of the wings must accordingly form a zigzag or wavy line, which, even at the first glance, suggests the thought that a folding must be the cause of this appearance.

If, now, one proceeds on the assumption that the wing-plates grow faster than the enclosing wing-sheath, which offers them only a narrow space, it is easily conceivable that the wing must lay itself in tolerably regular folds. And this is the more natural since the primary veins are formed by the thinning of the wing-skin, and, in consequence, most readily suffer bending and notching exactly upon these lines, while the intermediate fields at first appear only slightly convex, but by continued lateral pressure become ever more firmly compressed.

The primitive insect-wing is fan-like,—*i.e.*, formed out of regularly-alternating concave and convex veins. Such a fan, however, could be capable of complicated motions of flight only in case its convex veins, or at least a majority of them, were furnished with separate muscles. Since this, for evident reasons, is inconceivable, there remain only two ways out of the dilemma: either only one part of the wing is moved and the other passively drawn along, or there must take place such a uniting and grouping of the wing-veins that a smaller number of muscles suffice to move the wings correspondingly. In the first case an active flight is impossible. The wing works rather, in climbing, like a kite; in descending, like a parachute. This can be observed in those forms which still show approximately the fan type of wings

(the Saltatorial Orthoptera and Ephemeridæ). In the great mass of insects the second case is true; the veins of the original fan unite themselves into a few groups, which can be moved either independently or together, and yet require only a small number of muscles. The wing is divided, as a result, into a number of parts, which lie one behind another, and are united with each other by a sort of hinge. The latter can consist only of concave veins or folds, as these represent thinnings of the wing-plates.

In case of many insects (Lepidoptera and Diptera) it is a matter of some difficulty to determine the character of a vein. Concave veins often appear convex (subcosta of butterflies), while, on the other hand, convex veins take on the character of concave veins. In cases where concave and convex veins come into close relation, as with the flies, the true character of a vein is often scarcely recognizable. In general, concave veins run deeply, protrude more strongly on the under than on the upper side, cross-veins are frequently interrupted by them, and at the edge of the wing they often end at a re-entering angle, or, at least, into a baying-in of the margin. The convex veins, on the contrary, are, as a rule, swollen; they never interrupt cross-veins, and only exceptionally end in a re-entering angle, but, on the contrary, often cause at the end bayings-out of the wing-margin.

Redtenbacher defines five fields in the fully-developed wing of an insect. These are (1) the costal field, with the costa; (2) the radial field, with the radius and its numerous sectors; (3) the field of the fifth vein, or the medial field; (4) the cubital field, with the cubitus; and (5) the anal field. He also proposes a uniform nomenclature for the venation in all of the orders. The systems of convex veins running in the several fields are designated by the successive odd Roman figures,—*i.e.*, those of the costal field, by I.; of the radial field, by III.; of the medial field, by V.; of the cubital field, by VII.; and of the anal field, by IX., XI., XIII., etc. The concave line (veins or folds) running between the fine convex trunks he designates by the even Roman numerals,—thus, the concave line between veins I. and III. is indicated by II., and that between III. and V. by IV., etc. The several branches of a lengthwise vein are designated by indices appended to the Roman numerals. Arabic odd numerals are used in case of the convex veins, and Arabic even numerals for the concave,—*i.e.*, the sectors of the radius are designated as III_1, III_3, III_5. If, as is frequently the case, concave folds or veins appear between the branches of a convex trunk, they are designated by the Roman numerals of the convex system in question, with an even Arabic numeral added as an index,—thus, a concave vein between III_3 and III_5 is indicated as III_4.

Redtenbacher gives a table showing the equivalents in his system of the terms employed in the various systems in common use.—*J. H. C.*

The Genera of North American Phalangiinæ.—In working over the rich collections of harvest-men belonging to the Illinois State Laboratory of Natural History, in connection with recent European literature, I find that very few of the species described by Wood,[1] under the old genus *Phalangium*, belong to that genus as now restricted by the best European authorities. I have before me specimens of eight of the species treated by Wood (my determinations of all but two of them having been verified, through the kindness of Mr. Charles W. Woodworth, by comparison with the types in the Museum of Comparative Zoology), and I find that *P. dorsatum*, *vittatum*, *nigropalpi*, and *verrucosum*, all belong to the genus *Liobunum* of C. Koch, as defined by Simon.[2] I have also provisionally referred *P. formosum* and *P. calcar* to this genus, though, on account of the projecting inner angle of the palpal patella in the former and the spur-like process on the outer ventro-lateral surface of the femur of the palpus in the latter, they do not appear to strictly belong to it. *P. cinereum* falls into the restricted genus *Phalangium*, and *P. pictum* goes to *Oligolophus*. I suspect that *P. bicolor* and *P. ventricosum* also belong to *Liobunum*.

In this connection, I desire to call the attention of collectors to a simple method by which the genital organs of the Phalangiinæ may be exposed for study,—a fact which aids considerably in their determination, as these organs, especially in the male, frequently have specific peculiarities. If the caudal portion of the abdomen be compressed between the thumb and finger, the genital organs will be pushed out of the genital opening between the coxæ, and, if the specimen be dropped immediately into alcohol, will generally remain exposed. This method of protruding the genital organs was first described by Latreille in 1796, but does not seem to have been known to many later writers. It is very much preferable to the method of dissection described by Wood. I incline to believe that by its use good distinguishing characters can be obtained from the ovipositor, which will aid in separating the females of certain species that closely resemble each other.—*Clarence M. Weed, Illinois State Lab. Nat. Hist., Champaign*, 18th August, 1887.

ZOOLOGY.

Key to the Recent Families of Sponges.—The following "key" is taken from Dr. R. von Lendenfeld's recent paper (*Proc. Zool. Soc. London*, 1886, pp. 558–662, 1887) on the "Systematic Position and Classification of Sponges":

0.	Skeleton calcareous	1
	No calcareous skeleton	6
1.	Entoderm consists exclusively of collar-cells	2
	Entoderm consists of collar- and pavement-cells	3

[1] Commun. Essex Inst., vol. vi. pp. 10–40. [2] Arach. de France, vol. vi. p. 172.